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ABSTRACT

Current approaches to inservice teacher education emphasize process and do not adequately address the maintenance and development of teachers' subject area expertise. It is possible that a well-documented curriculum can furnish adequate teacher renewal for content updating. However, how teachers will judge, select, and use appropriate materials without opportunities to expand their subject knowledge remains an unanswered question. Two studies of elementary, secondary, and middle school teachers suggest that teachers use eclectic and individualized approaches and a wide variety of sources, some of which are supported by their school or school district, to update their content knowledge. However, budget restrictions have curtailed school district efforts to support teacher inservice needs. The situation resembles a vicious circle wherein students' lowered test scores have led teachers to use their expertise to choose appropriate course material. Although these materials are often developed and tested according to teachers' specifications, there is less inservice support for teachers' content renewal. The need seems to be for a systematic and continual use of a basic staff development model that features high participant involvement, communication skills, interaction with content experts, and translation of content into learning activities. (FG)

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TEACHERS' EXPERTISE IN SUBJECT MATTER: A CATCH 22*

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Abstract.

This paper examines the place of content expertise of the teacher in respect to instruction, the need for staff development in the content areas, the current forms of staff development and inservice in respect to content focus, and the liklihood that teachers will engage in their own staff development to up-date their content expertise.

Teachers' Content Expertise as Part of Instruction

Joseph Schwab (1978) describes the four commonplaces necessary for successful instruction:

the learner	the milieu
the teacher	the subject matter

If the learner wants to learn, if the teacher can teach, if the setting supports learning, and if the subject matter is adequate, learning can be optimal. However, the interdependency of the four commonplaces predicts that learning is only as successful as the weakest link. This paper examines one link--subject matter.

The subject matter has dimensions far beyond the stereotypic notions of an archival repository of facts or the performance of minimal basic skills.

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John Ciardi expands the concept to include questioning:

> "A good question is never answered. It is not a bolt to be tightened into place, but a seed to be planted and to bear more seed toward the hope of greening the landscape of idea.1

John Lubbock adds the dimension of perspective:

> There are three great questions which in life we have over and over again to answer: Is it right or wrong? Is it true or false? Is it beautiful or ugly?2

The broader dimensions of subject matter are described by Elliot Eisner (1978) as connoisseurship. He includes, in addition to exploration, various styles of knowing and aesthetics, the conventions of language, and the traditions of thought from the respective fields. It is all of these facets of subject matter that will be included subsequently in the use of the terms content, subject matter, and expertise.

At first thought, the focus on content appears to be a position most congruous to secondary and college level instruction. However, the University of Massachusetts Model Elementary Teacher Education Program (METEP) takes a rather hard line position in favor of a solid grounding in content as a necessary part of teachers' preparatory and inservice training (Burdin & Lanzilotti, 1969). The visual conceptualization is portrayed in Figure 1. The report states:

> The rationale for this requirement is our belief that every elementary school teacher should know at least something about the various competency areas represented by a differentiated staff, if for no other reason than to improve communication and open-mindedness among teachers (p.219).
>
> Content knowledge is defined to include the depth and breadth of content most often seen as deriving from undergraduate liberal arts courses as well as the kind of content knowledge most often associated with that acquired within a school of education. The latter is seen as a logical extension of the former, inseparable but focused on questions of relevance and conceptual organization for pupils at the elementary level (p.221). What criteria we settle on for preservice programs and whatever training procedures we judge relevant at that level must be applied and extended in our inservice programs (p.227).

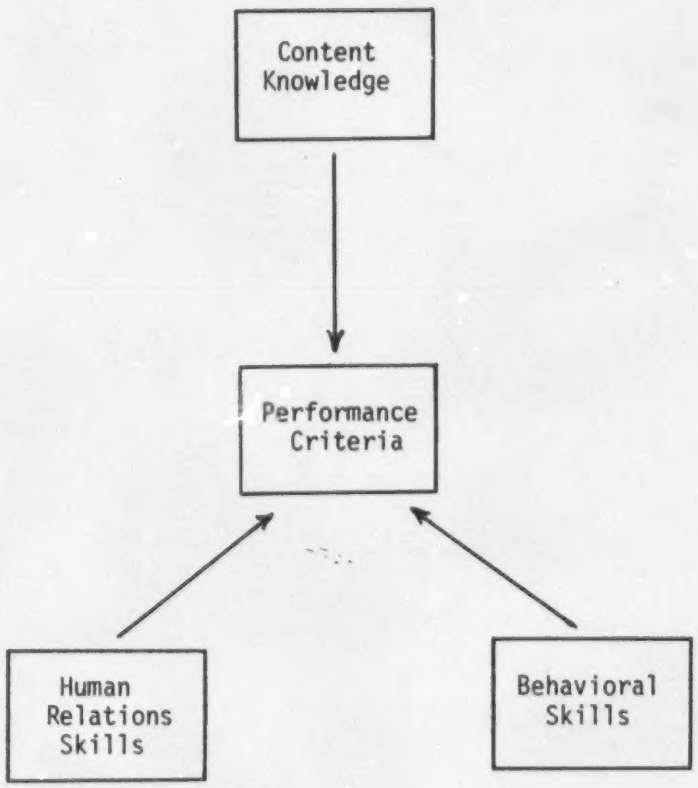

Figure 1. University of Massachusetts Model of Performance Criteria For Elementary Teacher Education

Although the preceding arguments seem to be primarily the view of those who advocate the philosophical orientation of the academic subject curriculum (McNeil, 1981), communications models, generally thought of as representing the technological orientation, also promote the importance of content. Berlo (1960) describes a model of the communications process as including six ingredients: source of the communication, encoder, message, channel, decoder, and receiver. Content is implicit in the message ingredient. In addition, as shown in Figure 2, there is a knowledge component both in the source and the receiver:

> One cannot communicate what he does not know; one cannot communicate with maximum effectiveness what he does not understand (p.48).

Berlo elaborates further that the message has in addition to the component elements to be transmitted, the structure or arrangement of those message elements. The source must not only know the elements and the structure of the message he wishes to transmit, but he must also know how to arrange the elements and structure into thought. The source must also have skills in encoding through writing and speaking, and decoding through reading and listening. These skills influence the message and the message influences the skills. In addition, the source must have a positive attitude toward the content in the message.

Although the previous arguments support the premise that the content expertise of teachers is an important consideration, acceptance of that premise does not necessarily validate the demand for inservice or other forms of renewal in the content areas. The next section addresses the question of need for renewal in content.

The Need for Teacher Renewal

One of the METEP quotations leads to the conclusions that an integral part of ideal instruction is the continuing extension of the teacher's base of expertise.

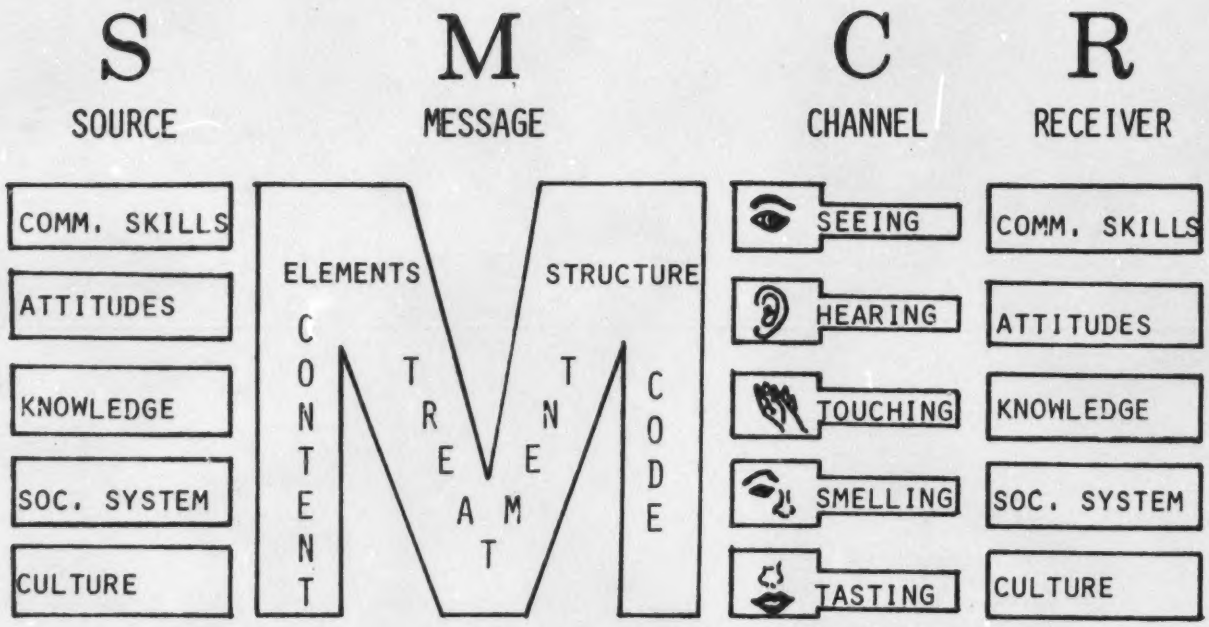

Figure 2. Berlo's (1960) Model of Communications Process

Wood, et al. (1981) build their rationale for staff development upon the statement:

> The best possible undergraduate preparation for teachers or graduate education for administrators and supervisors cannot serve professionals adequately for more than five to seven years in this age of rapid change and expanding knowledge. The moment educators leave their training institutions they embark upon a journey toward obsolescence. Somehow, educators must keep up with the new knowledge and technology in their areas of specialization (p.59).

It is easy to acknowledge the need for teachers to update their expertise in the science and technological fields. Other content areas are just as dynamic. Communication fields are not technological in nature and demand types of thinking about the process different from those used for person to person speaking or the usual forms of writing. Historical events occur daily. New political and economic theories are under constant evolution. New forms of art, music, literature, and drama avail themselves for public enjoyment. Theology shifts. And the pace at which all of these changes can be communicated increases geometrically.

Another dimension of renewal in the content areas is that of authenticity. During the 1960's curriculum writers took great pains to assure that the upgraded teachings to be transmitted were the best that contemporary minds could put together. More recently the entire new wave of effort in nutrition education was grounded in the concern that prior instruction had lost its authenticity (White House Conference, 1974). The new wave of interest in upgrading teachers' abilities to teach writing is based on the belief that a teacher must practice good writing, and the Bay Area Writing Project format puts teachers under the tutilege of professional writers.

If intuition fails to lead to the conclusion that renewal of faculty in the content areas is important, the instances cited demonstrate that the literature does offer support for the proposition. However, accepting the need for teacher

renewal in the content areas does not necessarily mean that current practices are remiss in this endeavor.

Staff Development Practices and the Renewal of Teachers' Content Expertise

Inservice education came of age during the 1960's and 1970's as a direct result of federal interest in upgrading instruction. The stimulus was a sequence of legislation to provide funding sources each bent on changing the thrust of instruction in some way commensurate with the most vocal concern at the time. The National Defense Education Act (NDEA) was followed by the entrance of the National Science Foundation (NSF) into precollege and college teaching. Later, the National Endowment of the Arts provided some equal time for the non-science sectors while the NSF added the social sciences to its spectrum of projects. Still later the National Elementary and Secondary Education Act seeded all sorts of temporary changes in curriculums or instruction.

All along, the assumption had been that the comprehensive curriculum was somehow deficient, and that experts should offer the curriculum changes and then teach the teachers how to implement those changes. But this subject focus began to fade from inservice offerings as funding was gradually reduced, as the nation became disenchanted with science, technology and the establishment, and as the professional teachers' organizations began negotiating inservice release time into the teaching contracts.

Currently several approaches to faculty renewal are practiced. The most frequently used is the scheduled inservice day in which teachers are released from teaching and are obligated to attend a combination of lectures, workshops, discussion sessions, or writing sessions, none of which approach very closely the interests of any given teacher, and virtually none of which are provided follow-up reinforcement during the remainder of the school year. A high proportion of these

inservices are dedicated to the improvement of instructional technique. (Brimm & Jollett, 1974; Armsworth, 1976; Joyce & Peck, 1977; Zigarmi & Jensen, 1977).

A second approach includes a staff development and organizational development approach. (Dillon-Peterson, 1981). The emphasis in staff development focuses on enhancing the personal and professional growth of the teachers in preparation for their participation in the organizational decision-making and program implementation. The basis of the approach is similar to that of organizational development. Both depend on goal setting and developing communication and interpersonal skills. Whereas organizational development seeks to improve the functioning of the organization, staff development seeks to improve instructional programs and delivery through staff involvement. They are complementary.

A third approach also employs communication skills as a basis for improving instruction. Clinical supervision is essentially an instructional process in which a supervisor and teacher work as a team: the supervisor gathers data which are analyzed together with the teacher and are used in deciding the changes that need to be tried. The approach, like staff development and organizational development, emphasizes process.

A fourth approach has been the competency-based education and competency based teacher education movement. In this approach, instructional goals and objectives become the standard for accountability. In good technological fashion teachers are taught how to design instruction by objectives in concert with evaluation methods toward attainment of mastery.

In all four approaches the selection of appropriate content is not addressed. It is not clear whether it is assumed that teachers have learned sufficient content in their preparatory programs to suffice, or that the curriculum takes care of the content, or that supervisors exercise quality control, or that the textbooks

constitute adequate content. Reality is probably some vague combination of these assumptions.

Three trends disquiet the adequacy of these assumptions. The first is illustrated by a personal experience. Recently, a team of Penn State educators and nutritionists developed a set of instructional materials in nutrition, designed with the assistance of teachers of students in the respective targeted grade levels. After test runs showing successful learning by students taught by their own teachers using the materials, publishers were sought to disseminate the program. Marketing analyses indicated that there was sufficient demand for the nutrition materials, but this particular program was identified by teachers as being too difficult for their students.

The readibility and mathematics expectations were commensurate with the capabilities of students in the targeted grade levels. Concept loads were adequately small also. Apparently, textbook companies level their content according to the teachers' judgements of appropriateness. Teachers seem to make their judgements according to their own background or that which their students already have achieved.

A second trend brought about by tighter budgets is the erosion of the school district positions for content specialists. To be sure, some of the displaced specialists have returned to classroom teaching, but others have retired from the profession. The generalist supervisor is then charged with the responsibility for adequate content in all disciplines, an unlikely prospect for success.[3]

A third trend brought about by declining enrollments and tighter budgets is the reduction in teacher turnover--a loss of fresh blood into the system. A recent study in Washington, D.C. showed that few teachers had taught less than six years (Evans, 1982). In one large district, the least senior teachers have eight years of

experience.[4] This trend suggests that the advantages of current knowledge comprising undergraduate education is less likely to benefit students in the schools.

Although it is possible to include content expertise as a goal of the various forms of teacher renewal, the approaches used currently emphasize process. The content is left to other avenues, possibly the curriculum.

The Curriculum Contribution to Teachers' Content Expertise

Possibly the curriculum furnishes adequate teacher renewal for content updating. The impact of curriculum is dependent upon the degree to which an adopted program is supported by the availability of materials, the regularity with which repeated opportunities are offered for the teachers to share and discuss problems and solutions, the availability of outside experts to guide and/or train teachers throughout the year, and the commitment of the district to the program (Welch & Willson, 1977).

Ford Foundation studies (Nachtigal, 1972) indicate the the most crucial factor for implementing change is the director of the curriculum change who remains through the entire sequence of planning, implementation, evaluation, and adaptation of a curriculum change. Impact is increased when there is scholarly input to assure intellectual rigor and appropriate methodologies to assure learning, evauation, teacher training, and dissemination. Impact is also increased according to the credibility of the supervisor (Shrigley, 1980).

However, the ultimate determiner of the success of curriculum in impacting on student learning is the acceptance of the curriculum change by the teacher. McNeil (1981) indicates that acceptance by teachers is a function of their involvement in selecting the material to be included in the curriculum and in developing those materials into activities, skills, attitudes, and concepts that

comprise a relevant instructional program. It is this necessity for teachers to be involved in all aspects of the curriculum development, including the selection of content to be included, that poses the dilemma. How do teachers obtain the new content information and perspectives to know what to select?

The primary candidate for serious and regular attention to content is the curriculum adoption process, which is relatively ineffective when it incorporates the teachers as the key decision makers. The deficiency in this procedure is that there is currently reduced opportunity for teachers to expand their own content expertise--unless, of course they do it on their own.

Teachers' Sources of Content Expertise: Questionnaire Results.

The purpose of this study was to test the assumption that teachers did indeed practice ways of updating and upgrading their content expertise by tapping authentic sources without the need for systematic staff development programs initiated by their school districts. A secondary assumption was that teachers would use a variety of sources in this effort.

Teachers enrolled in a beginning course in supervision completed a questionnaire in which they were asked which of the listed sources they thought teachers used for obtaining subject matter information. They were also asked to indicate their own practices and the practices they thought would be desirable professionally. The results in Table 1 indicate that all listed sources were used, and that their own practices were between those estimated for other teachers and the desirable expectation. The important conclusions were that (1) teachers are perceived as using a wide variety of sources for content information, (2)other sources not found on the list are probably used also, and (3) the authenticity of a number of the choices could be questioned.

A second questionnaire was administered to the same students to determine whether creativity was perceived as being related to subject matter expertise. The results are shown in Table 2.

The results of item 26 indicate that this group of respondents constitutes a biased sample in that they perceive themselves as being relatively creative. This perspective raises the question "Do respondents who do not see themselves as relatively creative generate a different profile of responses on the other items?"

Since attitudes affect other responses, it is not surprising to learn that the "relatively creative" respondents tend to support that statement which leaves them license to apply creativity to their own learning (#27), and to absolve themselves from the restrictions imposed by structured courses in content (#20, 21, 22, 24, 25, 28). Interestingly, respondents agree that subject matter relates to creative teaching (#19), and do not feel that they possess sufficient background to teach enthusiastically all of the content areas (#29). Evidently, confidence in their own capacity for self-instruction allays concern about lack of background sufficiently to ward off any feelings of need for more content courses. The perception of the value of content with methodology is unclear (#23). The questionnaire should include counterpart items about methodology.

Conclusions from this section of the questionnaire suggest that (4) indeed these potential supervisors felt insufficiently grounded to serve as content experts in all fields; (5) creativity, which should be related to connoisseurship, was perceived as related to subject matter; and (6) acquisition of sufficient content was not perceived as being dependent upon formal coursework.

Structured response questionnaire results may not be representative of actual practice as related in oral free response. The next section describes oral interview responses.

Teachers' Sources of Content Expertise: Interview Results

This study was conducted (1) to determine the degree to which the sources of subject matter expertise marked in the questionnaire by aspiring supervisors would be identified in oral free responses by teachers; (2) to identify activities perceived by teachers as being appropriate for school districts for increasing teachers' subject matter expertise; and (3) to ascertain the degree teachers involved in a curriculum project viewed the project resources as useful in enhancing teachers' content expertise.

Table 3 indicates that most of the sources identified in the questionnaire were also initiated by respondents (items 1-18). Interesting omissions included college textbooks (#4), undergraduate courses (#8), inservice credit courses (#10), classroom visitations (#12), distinguished speakers (#15), and conversations with friends (#18). However, twenty additional sources were reported. These results confirm the tendency of teachers to be eclectic and individualistic in seeking their content information.

In addition, the results suggest that high school science teachers tend to draw on a wider array of sources than do middle school science teachers or elementary teachers. Interesting is the relative frequency with which teachers drew from student textbooks, school library reference books, popular magazines and newspapers, educational television, and the media selected for classes. The curriculum guides were a source for half the respondents, and a third of them used periodicals in the subject field.

The scattered use of the various resources suggests that sources vary according to the particular type of need. This hypothesis is supported by the variety of ways suggested for districts to help in content updating (see Appendix A). There appears to be receptivity by teachers to upgrade their content expertise, but no attempt was made to determine the relative priority of commitment toward

this end. The nature of many of the suggestions indicated that commitment may be low.

Staff Development in the Content Areas - A Catch 22?

Assuming that teacher renewal in subject fields is a desirable goal as part of the total effort for improving instruction, the results of these two small studies suggest that teachers could stand some support from their disticts in upgrading content expertise. If the sample is representative, teachers do make some effort, and apparently do not have to be sold on the idea. The question of rate of renewal to keep up with the times is unanswered.

The I/D/E/A/ model for staff development seems to meet many of the teacher needs not addressed in the giant projects of the past decades. Particularly, the need for interpersonal trust development early in the staff development program is essential, even if the main thrust is to learn new concepts from a discipline. In addition, experiential learning is necessary because of the apparently widespread dependence of adults on concrete learning (Wood & Neill, 1976; Wood & Thompson, 1980; Wood, Thompson & Russell, 1981; Thompson & Wood, 1982; Wood, McQuarrie & Thompson, 1982).

In addition, recent literature from the fields of citizenship education, science education, writing improvement, nutrition education, environmental education, and energy education suggest additional characteristics for staff development in content expertise. First, outside expertise must be an integral part of the process because the teachers want authenticity. Second, teachers are reluctant to get serious about updating themselves unless they find they are deficient. This means some form of preassessment is necessary. However, teachers do not respond well to staff development techniques when they are threatened; tests threaten them. Fourth, new information presented out of context of their own personal or instructional application is considered as irrelevant and produces poorer impact

(Shrigley, 1980). Fifth, teachers seem to need respect from the persons providing the input in the content areas, but also need a substantial and frequent positive reinforcement while they are venturing into the unfamiliarity of new information and skills. Sixth, teachers need practice with feedback from the experts. Affectively, teachers grow more self-confident with the practice.

The literature and results of these studies indicate that, depending on the level of expertise of the teacher, the renewal of content expertise among the instructional staff is likely to be in a catch-22. Teachers tend to gear the content needs to the needs of the students, whose competence in various subject matters seem to continue to drop, according to the National Assessment in Education Program. Recognizing the needs of students for new content, teachers then draw from their experience in finding the new information.[4] Their experience dictates the authenticity of the sources, for those with advanced coursework use periodicals in the discipline, attend lectures, take advanced courses, or read the advanced level textbooks. Whereas, those with less background in the subject rely on their experience with the public media, children's trade books, school library resources, curriculum textbooks, and other instructional materials.

Textbooks and curriculum development frequently depend on the teachers' expertise, and there is less specialized leadership in the districts to promote authentic content changes. Minimum competency emphasis does not challenge the teachers to recognize weaknesses, but tests threaten them. They need outside expertise, but not in the form of courses or subject matter that is not translated into learning activities for the students. Teachers are receptive to upgrading their subject matter background, welcome assistance from the district, but do not welcome the usual format of inservice.

The state of the situation seems to be a milieu of little catch-22's, which left to themselves, are likely to yield little inconsistent improvement of instruction. The need seems to be for the use over several years of a basic staff development model that incorporates attention to high participant involvement, communication skills, interaction with content experts, and translation of the content into learning activities. The use of the model should be systematic and continual. The technology is available. The model just needs to be put together and used.

End Notes

1. John Ciardi, as quoted in The Reader's Digest, 1980, 117 (704) 144.
2. John Lubbock, as quoted in The Reader's Digest, 1980, 117 (704) 145.
3. From discussions with school district leaders in Pennsylvania. This is not necessarily a trend in the southeastern sector of the United States.
4. Conversation with high school administrators in an urban district in Pennsylvania, October 14, 1982.

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TABLE 1. Teachers' Sources of Subject Matter
As Perceived by Student In A First Course in Supervision

Teachers usually obtain subject information from which sources?	Teachers' Usual Practice				Your Usual Practice				Desirable Practice			
	Most of the time	Often	Sometimes	Almost never	Most of the time	Often	Sometimes	Almost Never	Most of the time	Often	Sometimes	Almost Never
1. Students' textbooks	2	6	2			4	5	1		3	7	
2. Teachers' guides for texts	4	5	1		2	6		2	2	6	2	
3. Library reference books		5	5			9			2	8		
4. College textbooks			7	3		1	9			2	8	
5. Current periodicals in the subject field			7	3		4	5		1	9		
6. Current periodicals on instruction			8	2		3	6	1	1	8	1	
7. Popular magazines/newspapers		3	6		1	7	2		2	6	2	
8. Undergraduate courses		1	5	4		2	6	2		2	7	1
9. Postgraduate college courses		3	5	2	1	5	4		1	6	3	
10. Inservice courses (credit)		1	8			5	5		1	7	2	
11. Inservice workshops (no credit)		1	6	2		2	7	1	1	7	2	
12. Classroom visitations			7	3	1		7	2	2	2	6	
13. Planning with other teachers		2	7	1	1	2	6	1	2	5	3	
14. Conferences		1	5	3		3	4	2	1	1	6	1
15. Distinguished speakers			7	3		1	7	1			8	1
16. Educational TV		1	7	2			8	2			10	
17. Media used in classes		3	7			6	4			6	4	
18. Conversations with friends			9	1			8	2			9	1

TABLE 2. Supervisor Students' Perceptions of the Relationship Between Subject Matter and Creative Teaching

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
19. Creative teaching is enhanced by the teacher having extensive knowledge of the subject being taught.	1	6	1	2	
20. The more courses a teacher has completed in a subject, the more likely instruction will be creative.			4	6	
21. The more specialized (as opposed to survey) the courses a teacher has completed in a subject, the more likely instruction will be creative.		2	2	5	1
22. The more recently a teacher has completed courses in a subject, the more likely instruction will be creative.		2	3	4	1
23. The more subject information in a course is accompanied by practice in instructional methods, the more creative will be the instruction.	1	2	5	2	
24. Creative instruction is not dependent upon the amount of subject coursework completed by the teacher.	3	6			
25. Creative instruction is not dependent upon the type of subject coursework completed by the teacher.	2	4	2	2	
26. The respondent is relatively creative in his/her instruction.	1	8	1		
27. Creative instruction is dependent upon self-instruction by the teacher.	3	5		1	
28. Creative instruction is dependent upon the teacher receiving good grades in subject.			3	4	3
29. I have sufficient background to teach all the topics enthusiastically.		1		8	

Table 3. Sources of Subject Matter Expertise Reported by Teachers Involved in a Three-Year Science Curriculum Project

Sources of Teacher's New Content	SHS (7)	MS (6)	ELEM (5)
1. Students' textbook	1	3	2
2. Teachers' guides for texts	1		
3. Library reference books	1	2	3
4. College textbooks			
5. Current periodicals in the subject field	3	2	1
6. Current periodicals on instruction	4	3	
7. Popular magazines/newspapers	2	3	5
8. Undergraduate courses			
9. Postgraduate college courses	1	1	
10. Inservice courses (credit)			
11. Inservice workshops (no credit)			2
12. Classroom visitations			
13. Planning with other teachers	1	1	
14. Conferences	1		
15. Distinguished speakers			
16. Educational TV		3	2
17. Media used in classes		1	2
18. Conversations with friends			
19. University Science Ed. Faculty	1		2
20. Student teachers	2		
21. Professional subject area societies	2		
22. Professional teaching societies	1		
23. University science faculty	3		
24. Publishers/equipment supply houses	1	1	
25. Make up my own	1		1
26. Curriculum guides/resources	2	3	4
27. Corporation materials, reports, magazines	1	1	1
28. Research reports on science education	1		
29. Governor's School of Sciences	1		
30. Junior research groups	1		
31. Community resources	2	1	
32. Student interests, contributions	1	1	
33. Books on the topic	2	1	1
34. Governmental Agencies (NASA)		1	
35. Personal activities - movies, antiques, etc.		1	
36. Writing committees			1
37. Commercial TV (news)			1
38. Children's trade books			2

APPENDIX A

ANSWERS TO THE QUESTION: WHAT WOULD BE THE MOST HELPFUL PRACTICES BY YOUR SCHOOL DISTRICT TO HELP YOU UPDATE OR UPGRADE YOUR SUBJECT MATTER EXPERTISE?

1. Provide budget to obtain what we need to implement what we learn.
2. Provide release time to capitalize on special opportunities such as conferences, annual meetings, special speakers, seminars.
3. Pay registration fees for us to attend local conferences, seminars, speakers.
4. Bring good people to the faculty (as part of staff development) who have own ideas about stimulating student interest.
5. Provide update seminars. (2)
6. Provide office space to keep materials together.
7. Provide more information from the science coordinator re: workshops, special speakers, opportunities.
8. Provide update workshops.
9. Circulate newsletters which share recent developments, articles on new topics, new information about old topics, systematic reviews of the literature, news in the field.
10. Update local resources in the resource pool.
11. Establish priorities of content for each grade level of students (and each track within level) so time could be devoted to the most important topics.
12. Provide laboratory equipment.
13. Provide a chance and encouragement to work with students on individual projects for the science and engineering fair, Junior Science and Humanities Symposium, Junior Academy of Science, Science Bowl, Westinghouse, etc.
14. Encourage the state department of education to coordinate activities which help teachers meet specifications and deadlines of #13.
15. Provide reprints of current articles.
16. Circulate appropriate journals for perusal by teachers. (2)
17. Circulate information on current A-V and instructional materials for the various topics. (3)
18. Circulate excerpts of new information on the various topics. (3)
19. Provide inservice for new teachers.
20. Underwrite summer course credit. (3)
21. Provide short courses. (2)

22. Circulate an idea exchange of techniques used by other teachers, including reproduceable student worksheets, etc. (Annotated references are useless because teachers do not have time to look up the sources.) (4)

23. Provide permission requesting service to obtain use of copyrighted information.

24. Support and provide suggestions for local field trips. (2)

25. Develop slide sets, videotapes or motion pictures of field trip sites to bring the field trips to students in the classroom.

26. Arrange for periodic seminars with professors to see what students should know before they enter college.

27. Provide ready-to-use lab sheets to go with the curriculum. (2)

28. Provide packets of resources to be retained at each school.

29. Encourage other teachers (who did not write the lessons) to substitute new activities for the exercises in the curriculum.

30. Review new instructional materials quickly and disseminate them quickly to teachers.

31. Put computers in schools. (2)

32. Hire facilitators in schools to help teachers plan then go round up materials.

33. Provide occasional professional day workshops for reviewing new methods and materials.

34. Circulate reviews of new books with recommendations about their usefulness.

35. Help teachers develop multi-level methods for same objectives.

36. Provide synopses of information from various resources for ready use in the unit. Include background teacher information right with the information on how to teach the unit.

37. Not thrilled about workshops after school. (6)

38. Circulate new activities as they come up in the news. (2)

39. Help arrange for knowledgeable people to come to the classes to present new information.

40. Build close relationships between the university, teachers, and schools (program).

41. Supply experts who can put the information on <u>our</u> (students and teacher) level.

42. Provide brush-up in a subject field by an expert for a couple of sessions.

43. Provide lists of resources.

44. Opportunity to develop with help from university staff development program on technology: why and how of equipment (like vo-tech school approach).

45. Provide inservice at our school.

46. Provide materials all in one place so there is less demand for scrounging.

47. Provide contact with agencies that can be used as resources.

48. Present inservice with video-taped examples of teachers using science materials well.

49. Provide exhibits of materials that work well.

50. Provide visuals, like large leaf prints, that are colorful.

51. Provide petty cash or a credit system for getting incidental materials needed to make lessons work.

52. Arrange workshops where we can try activities that worked in other schools.

53. Provide self-contained texts that include the materials used for the activities.

54. Provide support for occasional trips to national or state conventions such as The National Science Teachers' Association, STEM workshops, etc.